

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
 - a substrate having first to fourth regions,
 - a first insulating film formed on the substrate in
5 the first region,
 - a first epitaxial layer formed on the substrate in
the second region and having an upper surface higher
than an upper surface of the first insulating film,
 - a first semiconductor layer formed on the first
10 insulating film with a space provided with respect to
the first epitaxial layer and having an upper surface
set at substantially the same height as the upper
surface of the first epitaxial layer, and
 - an element isolation insulating film formed in the
15 space and having an upper surface set at substantially
the same height as the upper surface of the first
epitaxial layer and the upper surface of the first
semiconductor layer.
 2. The semiconductor device according to claim 1,
20 wherein the first insulating film and element isolation
insulating film are formed of the same material.
 3. The semiconductor device according to claim 1,
further comprising:
 - a second insulating film formed on the substrate
25 in the third region,
 - a second semiconductor layer formed on the second
insulating film, and

a second epitaxial layer formed on the substrate
in the fourth region, having an upper surface set at
substantially the same height as an upper surface of
the second semiconductor layer and formed in contact
5 with the second insulating film and second
semiconductor layer.

4. A semiconductor device comprising:
 - a substrate having first and second regions,
 - a first insulating film formed on the substrate in
10 the first region,
 - an epitaxial layer formed on the substrate in the
second region with a first space provided with respect
to the first insulating film and having an upper
surface higher than an upper surface of the first
15 insulating film,
 - a semiconductor layer having a first portion
formed on the first insulating film and a second
portion which projects from a side surface of the first
insulating film on the epitaxial layer side and formed
with a second space provided with respect to the
20 epitaxial layer, upper surfaces of the first and second
portions being set at substantially the same height as
the upper surface of the epitaxial layer, and
 - an element isolation insulating film formed in the
25 first and second spaces and having an upper surface set
at substantially the same height as the upper surface
of the epitaxial layer and the upper surfaces of the

first and second portions.

5. A semiconductor device comprising:

a substrate having first and second regions,

10 a first insulating film formed on the substrate in
the first region,

an epitaxial layer formed on the substrate in the
second region with a first space provided with respect
to the first insulating film and having an upper
surface higher than an upper surface of the first
insulating film,

15 a semiconductor layer formed on the first
insulating film with a second space larger than the
first space provided with respect to the epitaxial
layer and having an upper surface set at substantially
the same height as the upper surface of the epitaxial
layer, and

20 an element isolation insulating film formed in the
first and second spaces and having an upper surface set
at substantially the same height as the upper surface
of the epitaxial layer and the upper surface of the
semiconductor layer.

25 6. The semiconductor device according to claim 4,
wherein the element isolation insulating film is formed
of a silicon nitride film.

7. A semiconductor device comprising:

a substrate having first and second regions,

25 a first insulating film formed on the substrate in

the first region,

a semiconductor layer formed on the first insulating film,

5 a first gate insulating film formed on the semiconductor layer,

a first gate electrode selectively formed on the first gate insulating film and having first and second electrode layers,

10 a second gate insulating film formed on the substrate in the second region,

a second gate electrode selectively formed on the second gate insulating film, having third and fourth electrode layers and having an upper surface set at substantially the same height as an upper surface of 15 the first gate electrode, and

an element isolation insulating film formed in a boundary portion between the first and second regions.

8. A semiconductor device comprising:

20 a substrate having first and second regions,

a first element isolation insulating film formed in a boundary portion between the first and second regions and partly formed to project from the substrate,

25 a second element isolation insulating film formed in the second region and partly formed to project from the substrate,

a first insulating film formed on the substrate in

the first region,

a semiconductor layer formed on the first insulating film,

5 a first gate insulating film formed on the semiconductor layer,

a first gate electrode selectively formed on the first gate insulating film and having first and second electrode layers,

10 a second gate insulating film formed on a portion of the substrate which lies between the first and second element isolation insulating films, and

15 a second gate electrode formed on the second gate insulating film, having a third electrode layer, a second insulating film formed on the third electrode layer and a fourth electrode layer formed on the second insulating film and having an upper surface set at substantially the same height as an upper surface of the first gate electrode,

20 wherein the third electrode layer has first to third portions which are formed continuous in a concave form, the first portion being formed on the second gate insulating film, the second portion being formed along a side surface of the first element isolation insulating film and the third portion being formed along a side surface of the second element isolation insulating film, and the second insulating film has fourth to eighth portions which are continuous, the

fourth portion being formed on the first portion, the
fifth portion being formed on the second portion, the
sixth portion being formed on the third portion, the
seventh portion being formed on the second portion and
5 first element isolation insulating film, and the eighth
portion being formed on the third portion and second
element isolation insulating film.

9. A semiconductor device comprising:
 - a substrate having first to third regions,
 - 10 a first insulating film provided on the substrate
in the first region and formed of a first material
film,
 - a semiconductor layer provided on the first
insulating film and formed of a second material film,
 - 15 a first gate insulating film provided on the
semiconductor layer and formed of a third material
film,
 - a first gate electrode selectively provided on the
first gate insulating film and formed of a fourth
20 material film,
 - a second gate insulating film provided on the
substrate in the second region and formed of the first
material film,
 - a second gate electrode selectively provided on
25 the second gate insulating film, having a first
electrode layer formed of the second material film and
a second electrode layer formed of the fourth material

film, and having an upper surface set at substantially the same height as an upper surface of the first gate electrode, and

5 a first element isolation insulating film formed in a boundary portion between the first and second regions.

10 10. The semiconductor device according to claim 9, wherein the first electrode layer is formed of a single crystal silicon layer.

10 11. The semiconductor device according to claim 9, further comprising:

 a third gate insulating film provided on the substrate in the third region and formed of the first material film,

15 15. a third gate electrode provided on the third gate insulating film, having a third electrode layer formed of the second material film, a second insulating film formed of the third material film and a fourth electrode layer formed of the fourth material film and
20 20. having an upper surface set at substantially the same height as the upper surfaces of the first and second gate electrodes, and

25 25. a second element isolation insulating film formed in a boundary portion between the second and third regions.

12. A manufacturing method of a semiconductor device comprising:

forming a wafer including a substrate, a first insulating film formed on the substrate and a semiconductor layer formed on the first insulating film and having first to fourth regions,

5 forming a second insulating film on the semiconductor layer in the first region,

selectively removing the semiconductor layer and first insulating film in the second region with the second insulating film used as a mask,

10 forming a space portion in the first region by setting back a side surface of the semiconductor layer on the second region side with respect to a side surface of the first insulating film,

15 forming a first element isolation insulating film in the space portion,

forming an epitaxial layer on the substrate in the second region by use of an epitaxial growth process until an upper surface of the epitaxial layer is set substantially equal in height to an upper surface of 20 the semiconductor layer,

removing the second insulating film, and

25 forming a first gate electrode on the semiconductor layer in the first region with a first gate insulating film disposed therebetween and forming a second gate electrode on the epitaxial layer in the second region with a second gate insulating film disposed therebetween.

13. The manufacturing method of the semiconductor device according to claim 12, wherein a thin portion of the first insulating film is left behind when the semiconductor layer and first insulating film in the second region are selectively removed and then the thin portion of the first insulating film is removed before the epitaxial growth process is performed.

14. The manufacturing method of the semiconductor device according to claim 12, wherein the first element isolation insulating film is formed of the same material as the first insulating film.

15. The manufacturing method of the semiconductor device according to claim 12, wherein the second insulating film is a silicon oxide film.

16. The manufacturing method of the semiconductor device according to claim 12, further comprising:

forming a third insulating film on the semiconductor layer in the third region when the second insulating film is formed,

selectively removing the first insulating film and semiconductor layer in the fourth region with the third insulating film used as a mask when the first insulating film and semiconductor layer in the second region are selectively removed,

covering a side surface of the portion of the semiconductor layer of the third region on the fourth region side with a mask, and

removing the mask after the space portion is formed.

17. The manufacturing method of the semiconductor device according to claim 12, further comprising:

5 forming a second element isolation insulating film to remove a facet in a case where the facet is formed on the epitaxial layer in a boundary portion between the first and second regions when the epitaxial growth process is performed.

10 18. A manufacturing method of a semiconductor device comprising:

forming a wafer including a substrate, a first insulating film formed on the substrate and a semiconductor layer formed on the first insulating film and 15 having first and second regions,

forming a second insulating film on the semiconductor layer in the first region,

selectively removing the first insulating film and semiconductor layer in the second region with the 20 second insulating film used as a mask,

forming a first space portion in the first region by setting back a side surface of the semiconductor layer on the second region side with respect to a side surface of the second insulating film,

25 forming a second space portion in the first region by setting back a side surface of the first insulating film on the second region side with respect to the side

surface of the second insulating film,

forming an element isolation insulating film in
the first and second space portions,

5 forming an epitaxial layer on the substrate in the
second region by use of an epitaxial growth process
until an upper surface of the epitaxial layer is set
substantially equal in height to an upper surface of
the semiconductor layer,

10 removing the second insulating film, and

10 forming a first gate electrode on the
semiconductor layer in the first region with a first
gate insulating film disposed therebetween and forming
a second gate electrode on the epitaxial layer in the
second region with a second gate insulating film
15 disposed therebetween.

19. The manufacturing method of the semiconductor
device according to claim 18, wherein the element
isolation insulating film is formed of a silicon
nitride film.

20. The manufacturing method of the semiconductor
device according to claim 18, wherein a width of the
first space portion is smaller than a width of the
second space portion.

25 21. The manufacturing method of the semiconductor
device according to claim 18, wherein a width of the
second space portion is smaller than a width of the
first space portion.

22. A manufacturing method of a semiconductor device comprising:

forming a wafer including a substrate, a first insulating film formed on the substrate and a semiconductor layer formed on the first insulating film and having first and second regions,

5 forming an element isolation insulating film in a boundary portion between the first and second regions to partly project from an upper surface of the semiconductor layer,

10 selectively removing the first insulating film and semiconductor layer in the second region,

forming a first gate insulating film on the semiconductor layer in the first region and forming a second gate insulating film on the substrate in the second region,

15 forming a first electrode member on the element isolation insulating film and first and second gate insulating films and making the first electrode member flat until an upper surface of the element isolation insulating film is exposed,

20 forming a second electrode member on the first electrode member and element isolation insulating film, and

25 forming a first gate electrode having a first electrode layer formed of the first electrode member and a second electrode layer formed of the second

electrode member in the first region and forming a second gate electrode having a third electrode layer formed of the first electrode member and a fourth electrode layer formed of the second electrode member
5 in the second region and having an upper surface set at substantially the same height as an upper surface of the first gate electrode by simultaneously processing the first and second electrode members.

23. The manufacturing method of the semiconductor device according to claim 22, further comprising forming a second insulating film between the first and second electrode members in the second region.

24. A manufacturing method of a semiconductor device comprising:

15 forming a substrate having first to third regions,
forming a first material film on the substrate,
forming a second material film on the first material film,

20 forming an element isolation insulating film in a boundary portion between the first and second regions and forming a second gate insulating film formed of the first material film in the second region,

25 forming a first gate insulating film formed of a third material film on the second material film in the first region,

forming a fourth material film on the first gate insulating film, the second material film in the second

region and the element isolation insulating film, and
forming a first gate electrode formed of the
fourth material film in the first region and forming a
second gate electrode having a first electrode layer
5 formed of the second material film and a second
electrode layer formed of the fourth material film in
the second region and having an upper surface set at
substantially the same height as an upper surface of
the first gate electrode by simultaneously processing
10 the fourth material film in the first region and the
second and fourth material films in the second region.

25. The manufacturing method of the semiconductor
device according to claim 24, further comprising:

15 forming a third gate insulating film formed of the
first material film on the substrate in the third
region, and

20 forming a third gate electrode having a third
electrode layer formed of the second material film, a
second insulating film formed of the third material
film and a fourth electrode layer formed of the fourth
material film on the third insulating film in the third
region.